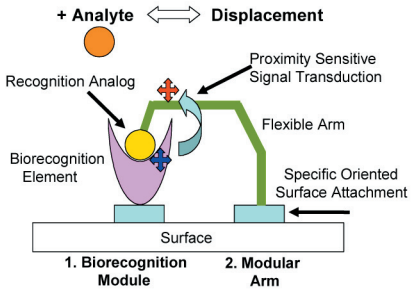
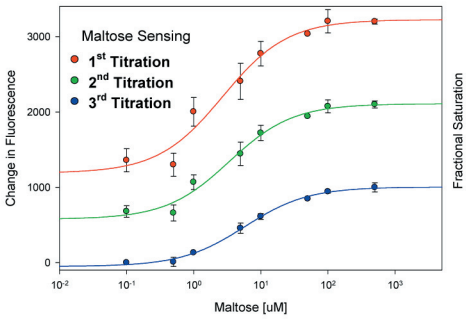
Adaptable Reagentless Biosensor

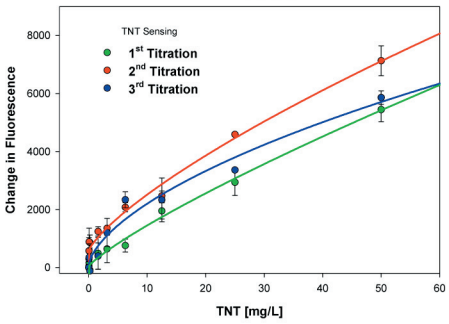
Sensor Schematic



Maltose



TNT



DESCRIPTION:

The Naval Research Laboratory (NRL) has developed a reagentless and regenerable biosensing technology, which is easily adapted to target many different analytes and whose binding affinity can be controlled. This biosensor is self assembled and consists of two co-functional entities: 1) a surface tethered biorecognition element such as a receptor protein and 2) a multifunctional tethered modular arm that contains a point of surface attachment, a flexible DNA linker, and a dye label, which is proximal to a recognition element (an analog of the primary analyte) that interacts with the receptor protein. These two entities are self assembled on the surface of a microtiter well and their close proximity, when the biorecognition element binds the analog on the modular arm, results in fluorescence resonance energy transfer (FRET) between the dyes. Addition of the target analyte displaces the analog on the arm, altering FRET in a quantifiable manner. Use of different protein mutants allows for sensors with different binding constants and addition of a DNA complement to the DNA flexible linker alters and extends the useful sensing range, demonstrating the modularity of this approach. The sensor can be washed free of analyte and regenerated for subsequent sensing events. More importantly, the sensor is easily adaptable to target other analytes and this was demonstrated by adapting the maltose sensing prototype to target a completely unrelated analyte, the explosive TNT. The panels above show three consecutive titrations of each sensor.

ADVANTAGES/FEATURES:

- **Self-assembles in microtiter well plates:** a format readily available to many biological labs
- **Reagentless:** sensing is monitored fluorescently and does not require any further processing
- **Regenerable:** sensors can be washed free of analyte, reassembled, and re-sense
- **Tunable affinities:** sensor affinity can be adjusted at multiple levels
- **Dries, stores and reconstitutes:** allows the possibility of shipping
- **Adaptable to other analytes:** easily accommodates receptor proteins and antibody fragments
- Patent pending: Navy case # 95,906

APPLICATIONS:

- Pathogen detection
- Industrial and bioprocess monitoring and quality assurance
- Nutrient sensing
- Chemical detection
- Environmental and agricultural monitoring
- Healthcare and drug discovery

References:

- I.L. Medintz, E.R. Goldman, M.E. Lassman, A. Hayhurst, A.W.K. Kusterbeck, and J.R. Deschamps, “A Self-assembled TNT Biosensor Based on Modular Multifunctional Surface-tethered Components,” *Analytical Chemistry* **77**, 365-372 (2005).
- I.L. Medintz, G.P. Anderson, M.E. Lassman, E.R. Goldman, L.A. Bettencourt, and J.M. Mauro, “General Strategy for Biosensor Design and Construction Employing Multifunctional Surface-Tethered Components,” *Analytical Chemistry* **76**, 5620-5629 (2004).
- Technology highlighted in B.E. Erickson, Modular (fill in the blank) biosensor. *Analytical Chemistry* **77**, 50A (2005).

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